

=> s cobalt or ruthenium or iron or rhenium or osmium

```

234778 COBALT
    76 COBALTS
234780 COBALT
    (COBALT OR COBALTS)
55120 RUTHENIUM
    17 RUTHENIUMS
55120 RUTHENIUM
    (RUTHENIUM OR RUTHENIUMS)
598148 IRON
    7864 IRONS
598594 IRON
    (IRON OR IRONS)
22553 RHENIUM
    8 RHENIUMS
22553 RHENIUM
    (RHENIUM OR RHENIUMS)
15774 OSMIUM
    5 OSMIUMS
15775 OSMIUM
    (OSMIUM OR OSMIUMS)
L1    836184 COBALT OR RUTHENIUM OR IRON OR RHENIUM OR OSMIUM

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=> s l1 and interfacial layer

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70192 INTERFACIAL
    4 INTERFACIALS
70192 INTERFACIAL
    (INTERFACIAL OR INTERFACIALS)
731362 LAYER
341537 LAYERS
903779 LAYER
    (LAYER OR LAYERS)
2478 INTERFACIAL LAYER
    (INTERFACIAL(W) LAYER)
L2    160 L1 AND INTERFACIAL LAYER

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=> s l2 and catalyst

```

450793 CATALYST
465958 CATALYSTS
569890 CATALYST
    (CATALYST OR CATALYSTS)
L3    1 L2 AND CATALYST

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=> d ibib abs

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L3    ANSWER 1 OF 1  CAPLUS  COPYRIGHT 2000 ACS
ACCESSION NUMBER:      2000:98413  CAPLUS
DOCUMENT NUMBER:       132:128333
TITLE:                 Multilayered catalyst and method for

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INVENTOR(S): preparation
 PATENT ASSIGNEE(S): Tonkovich, Anna Lee Y.; Wang, Yong; Gao, Yufei
 SOURCE: Battelle Memorial Institute, USA
 PCT Int. Appl., 15 pp.
 CODEN: PIXXD2
 DOCUMENT TYPE: Patent
 LANGUAGE: English
 FAMILY ACC. NUM. COUNT: 1
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2000006301	A1	20000210	WO 1999-US17083	19990727
W: CA, JP, MX, NO				
RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE				

PRIORITY APPLN. INFO.: US 1998-123781 19980727
 AB The present invention includes a **catalyst** that has at least four layers: (1) porous support, (2) buffer layer, (3) **interfacial layer**, and optionally (4) **catalyst** layer. The buffer layer provides a transition of thermal expansion coeff. from the porous support to the **interfacial layer** thereby reducing thermal expansion stress as the **catalyst** is heated to high operating temps. The method for making the at least three layer **catalyst** has the steps of: (1) selecting a porous support, (2) soln. depositing an **interfacial layer** thereon, and optionally (3) depositing a **catalyst** material onto the **interfacial layer**; wherein the improvement comprises (4) depositing a buffer layer between the porous support and the **interfacial layer**.

REFERENCE COUNT: 3
 REFERENCE(S): (1) Galligan, P; US 5422331 A 1995 CAPLUS
 (2) Pestryakov, A; REACTION KINETICS AND CATALYSIS LETTERS 1994, V53(2), P347 CAPLUS
 (3) Radmil, S; US 5690900 A 1997 CAPLUS

=> d it

L3 ANSWER 1 OF 1 CAPLUS COPYRIGHT 2000 ACS
 IT **Catalysts**
 Thermal expansion
 (prepn. of multilayered **catalyst** with buffer layer for reducing thermal expansion stress)
 IT Noble metals
 Oxides (inorganic), uses
 Rare earth oxides
 Transition metal oxides
 Transition metals, uses
 Zeolites (synthetic), uses
 RL: CAT (Catalyst use); USES (Uses)
 (prepn. of multilayered **catalyst** with buffer layer for reducing thermal expansion stress contg.)
 IT Stress, mechanical

(thermal; prepn. of multilayered **catalyst** with buffer layer
for reducing thermal expansion stress)

IT 1305-78-8, Calcium oxide, uses 1309-48-4, Magnesia, uses 1313-99-1,
Nickel oxide, uses 1314-13-2, Zinc oxide, uses 1314-23-4, Zirconia,
uses 1332-29-2, Tin oxide 1332-37-2, **Iron** oxide, uses
1344-28-1, Alumina, uses 1344-70-3, Copper oxide 7631-86-9, Silica,
uses 11098-99-0, Molybdenum oxide 11099-11-9, Vanadium oxide
11104-61-3, **Cobalt** oxide 11118-57-3, Chromium oxide
11129-60-5, Manganese oxide 12597-68-1, Stainless steel, uses
13463-67-7, Titania, uses
RL: CAT (Catalyst use); USES (Uses)
(prepn. of multilayered **catalyst** with buffer layer for
reducing thermal expansion stress contg.)

=> d his

(FILE 'HOME' ENTERED AT 14:57:14 ON 13 JUN 2000)

FILE 'REGISTRY' ENTERED AT 14:57:28 ON 13 JUN 2000

FILE 'CAPLUS' ENTERED AT 14:57:39 ON 13 JUN 2000

L1 836184 S COBALT OR RUTHENIUM OR IRON OR RHENIUM OR OSMIUM
L2 160 S L1 AND INTERFACIAL LAYER
L3 1 S L2 AND CATALYST

=> s cobalt oxide or ruthenium oxide or iron oxide or rhenium oxide or osmium
oxide

234778 COBALT
76 COBALTS
234780 COBALT
(COBALT OR COBALTS)
1036494 OXIDE
219800 OXIDES
1093461 OXIDE
(OXIDE OR OXIDES)
13982 COBALT OXIDE
(COBALT(W) OXIDE)
55120 RUTHENIUM
17 RUTHENIUMS
55120 RUTHENIUM
(RUTHENIUM OR RUTHENIUMS)
1036494 OXIDE
219800 OXIDES
1093461 OXIDE
(OXIDE OR OXIDES)
4247 RUTHENIUM OXIDE
(RUTHENIUM(W) OXIDE)
598148 IRON
7864 IRONS
598594 IRON
(IRON OR IRONS)
1036494 OXIDE

219800 OXIDES
 1093461 OXIDE
 (OXIDE OR OXIDES)
 57449 IRON OXIDE
 (IRON(W) OXIDE)
 22553 RHENIUM
 8 RHENIUMS
 22553 RHENIUM
 (RHENIUM OR RHENIUMS)
 1036494 OXIDE
 219800 OXIDES
 1093461 OXIDE
 (OXIDE OR OXIDES)
 1397 RHENIUM OXIDE
 (RHENIUM(W) OXIDE)
 15774 OSMIUM
 5 OSMIUMS
 15775 OSMIUM
 (OSMIUM OR OSMIUMS)
 1036494 OXIDE
 219800 OXIDES
 1093461 OXIDE
 (OXIDE OR OXIDES)
 577 OSMIUM OXIDE
 (OSMIUM(W) OXIDE)
 L4 73950 COBALT OXIDE OR RUTHENIUM OXIDE OR IRON OXIDE OR RHENIUM OXIDE
 OR OSMIUM OXIDE

=> s 14 and catalyst

450793 CATALYST
 465958 CATALYSTS
 569890 CATALYST
 (CATALYST OR CATALYSTS)
 L5 11428 L4 AND CATALYST

=> s 15 and bilayer

32534 BILAYER
 14040 BILAYERS
 37463 BILAYER
 (BILAYER OR BILAYERS)
 L6 11 L5 AND BILAYER

=> d ti 1-11

L6 ANSWER 1 OF 11 CAPLUS COPYRIGHT 2000 ACS
 TI Properties and industrial applications of DC-type **catalysts** for
 ethylbenzene dehydrogenation

L6 ANSWER 2 OF 11 CAPLUS COPYRIGHT 2000 ACS
 TI Supported membrane/electrode structure combination wherein catalytically
 active particles are coated onto the membrane

- L6 ANSWER 3 OF 11 CAPLUS COPYRIGHT 2000 ACS
 TI Industrial molybdenum trioxide-promoter oxide-.gamma.-alumina hydrotreating **catalysts**: genesis and architecture description
- L6 ANSWER 4 OF 11 CAPLUS COPYRIGHT 2000 ACS
 TI Temperature-programmed reduction of cobalt monoxide-molybdena/alumina **catalysts**
- L6 ANSWER 5 OF 11 CAPLUS COPYRIGHT 2000 ACS
 TI Catalytic deactivation of cobalt-molybdenum hydrodesulfurization **catalysts** supported on .gamma.-aluminum oxide doped with lithium(+) ions
- L6 ANSWER 6 OF 11 CAPLUS COPYRIGHT 2000 ACS
 TI Surface structure of cobalt(II) oxide-molybdena/alumina **catalysts** studied by x-ray photoelectron spectroscopy
- L6 ANSWER 7 OF 11 CAPLUS COPYRIGHT 2000 ACS
 TI Ion scattering spectrometric study on the structure of **bilayers** of molybdenum and **cobalt oxides** at the support surface of hydrodesulfurization **catalysts**
- L6 ANSWER 8 OF 11 CAPLUS COPYRIGHT 2000 ACS
 TI Structure of oxide cobalt-molybdenum/.gamma.-alumina hydrodesulfurization **catalysts**: an XPS and DRS study
- L6 ANSWER 9 OF 11 CAPLUS COPYRIGHT 2000 ACS
 TI Experimental evidence for the existence of a cobalt-molybdenum **bilayer** on .gamma.-alumina-supported cobalt-molybdenum hydrodesulfurization **catalysts**
- L6 ANSWER 10 OF 11 CAPLUS COPYRIGHT 2000 ACS
 TI A not-well-known factor in the dispersion of oxidized molybdenum and cobalt species at the surface of hydrodesulfurization support **catalysts**
- L6 ANSWER 11 OF 11 CAPLUS COPYRIGHT 2000 ACS
 TI Physicochemical characterization of the interaction between cobalt molybdenum oxide and silicon dioxide. 1. Influence of the cobalt-molybdenum ratio

=> l5 and hydrogenation

L5 IS NOT A RECOGNIZED COMMAND

The previous command name entered was not recognized by the system. For a list of commands available to you in the current file, enter "HELP COMMANDS" at an arrow prompt (=>).

=> sl5 and hydrogenation

SL5 IS NOT A RECOGNIZED COMMAND

The previous command name entered was not recognized by the system. For a list of commands available to you in the current file, enter "HELP COMMANDS" at an arrow prompt (=>).

=> s 15 and hydrogenation

105771 HYDROGENATION
 1187 HYDROGENATIONS
 105874 HYDROGENATION
 (HYDROGENATION OR HYDROGENATIONS)
 L7 1273 L5 AND HYDROGENATION

=> s 17 and layer

731362 LAYER
 341537 LAYERS
 903779 LAYER
 (LAYER OR LAYERS)
 L8 18 L7 AND LAYER

=> d ti 1-10

L8 ANSWER 1 OF 18 CAPLUS COPYRIGHT 2000 ACS
 TI Ferromagnetic particles and their preparation

L8 ANSWER 2 OF 18 CAPLUS COPYRIGHT 2000 ACS
 TI Application of copper based non-chromium **catalyst** to the natural fatty alcohol production

L8 ANSWER 3 OF 18 CAPLUS COPYRIGHT 2000 ACS
 TI Process for hydrogenating benzene in hydrocarbon oils

L8 ANSWER 4 OF 18 CAPLUS COPYRIGHT 2000 ACS
 TI Manufacture of **hydrogenation catalysts** for high desulfurization activity

L8 ANSWER 5 OF 18 CAPLUS COPYRIGHT 2000 ACS
 TI Studies on the constituent state **hydrogenation** activity of adsorbing resin-supported bimetallic **catalysts**

L8 ANSWER 6 OF 18 CAPLUS COPYRIGHT 2000 ACS
 TI Modular surface catalyzed membrane containing a microporous membrane **catalyst layer** and transport **layer**

L8 ANSWER 7 OF 18 CAPLUS COPYRIGHT 2000 ACS
 TI The effect of metallic promoters on supported cobalt **catalysts**

L8 ANSWER 8 OF 18 CAPLUS COPYRIGHT 2000 ACS
 TI **Hydrogenation** of residual oils

L8 ANSWER 9 OF 18 CAPLUS COPYRIGHT 2000 ACS
 TI Kinetics of wet atmosphere reduction of a fused iron **catalyst** for ammonia synthesis

L8 ANSWER 10 OF 18 CAPLUS COPYRIGHT 2000 ACS
 TI Surface structure and catalysis for carbon monoxide **hydrogenation** of the supported ruthenium species derived from the ruthenium carbonyl

(Ru₃(CO)₁₂) inorganic oxides

=> d ti 10-18

- L8 ANSWER 10 OF 18 CAPLUS COPYRIGHT 2000 ACS
TI Surface structure and catalysis for carbon monoxide **hydrogenation** of the supported ruthenium species derived from the ruthenium carbonyl (Ru₃(CO)₁₂) inorganic oxides
- L8 ANSWER 11 OF 18 CAPLUS COPYRIGHT 2000 ACS
TI Manufacture of porous, metal-containing carbonaceous materials, and the materials obtained
- L8 ANSWER 12 OF 18 CAPLUS COPYRIGHT 2000 ACS
TI XPS and ISS analysis of Fischer-Tropsch **catalysts**
- L8 ANSWER 13 OF 18 CAPLUS COPYRIGHT 2000 ACS
TI Design of more selective Fischer-Tropsch **catalysts** by using rationalized activity patterns
- L8 ANSWER 14 OF 18 CAPLUS COPYRIGHT 2000 ACS
TI First experience and results of the 200-ton/day pilot plant Bottrop
- L8 ANSWER 15 OF 18 CAPLUS COPYRIGHT 2000 ACS
TI Homogenizing metal oxide **catalysts**
- L8 ANSWER 16 OF 18 CAPLUS COPYRIGHT 2000 ACS
TI Reclaiming waste lubricating oils by hydrotreating after washing with a polyglycol ether
- L8 ANSWER 17 OF 18 CAPLUS COPYRIGHT 2000 ACS
TI Reclaiming waste lubricating oils by hydrotreating
- L8 ANSWER 18 OF 18 CAPLUS COPYRIGHT 2000 ACS
TI **Hydrogenation** of lignin

=> d ibib abs 11 12 13 14 10 8

L8 ANSWER 11 OF 18 CAPLUS COPYRIGHT 2000 ACS
ACCESSION NUMBER: 1990:124086 CAPLUS
DOCUMENT NUMBER: 112:124086
TITLE: Manufacture of porous, metal-containing carbonaceous materials, and the materials obtained
INVENTOR(S): Tachibana, Masao
PATENT ASSIGNEE(S): Somar Corp., Japan
SOURCE: Eur. Pat. Appl., 4 pp.
CODEN: EPXXDW
DOCUMENT TYPE: Patent
LANGUAGE: English
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
EP 348204	A2	19891227	EP 1989-306332	19890623
EP 348204	A3	19910206		
EP 348204	B1	19931118		
R: DE, FR, GB				
JP 02006308	A2	19900110	JP 1988-154893	19880624
JP 2615140	B2	19970528		
US 4970189	A	19901113	US 1989-370020	19890623
PRIORITY APPLN. INFO.:			JP 1988-154893	19880624

AB. The title process comprises (a) providing finely divided particles of a metal oxide having av. particle size $\geq 1 \mu\text{m}$, (b) mixing the particles with an org. substance, and (c) carbonizing the mixt. in a nonoxidizing atm. to convert the org. substance into a carbonaceous body, and to convert the metal oxide particles into metal particles dispersed in the carbonaceous body. The products have an open cellular structure, and, depending on the metal, may be used as O absorbents, **hydrogenation catalysts**, absorbents for gases contg. HCl or SO₂, and as shields for electromagnetic waves. A mixt. of coal powder (av. particle size ≥ 200 mesh) 100, Fe₂O₃ powder (coated with monomol. **layer** of K stearate; av. particle size 50 μm .) 50, and soft pitch (softening point $\approx 50^\circ\text{C}$.) 30 wt. parts was kneaded at 75°C . and molded, and the resulting blocks were heated in a nonoxidizing atm. to 850°C . at $10^\circ\text{C}/\text{min}$, and held at 850°C . for 30 min. The product was ground, and then 100 wt. parts of the powder was mixed with 30 wt. parts 15% NaCl soln. to obtain an O adsorbent.

L8 ANSWER 12 OF 18 CAPLUS COPYRIGHT 2000 ACS
 ACCESSION NUMBER: 1989:647058 CAPLUS
 DOCUMENT NUMBER: 111:247058
 TITLE: XPS and ISS analysis of Fischer-Tropsch **catalysts**
 AUTHOR(S): Lindner, U.; Papp, H.
 CORPORATE SOURCE: Ruhr-Univ. Bochum, Bochum, D-4630, Fed. Rep. Ger.
 SOURCE: Fresenius' Z. Anal. Chem. (1989), 333(4-5), 540-4
 CODEN: ZACFAU; ISSN: 0016-1152
 DOCUMENT TYPE: Journal
 LANGUAGE: English

AB The surface compns. of K and Cu contg. Fe/Mn oxide **catalysts** for Fischer-Tropsch synthesis were detd. by XPS and ion-scattering spectroscopy (ISS). The surface species after calcn. are identified as Fe₂O₃, Mn₂O₃, MnO₂, CuO and most likely KO₂, and after in situ redn. at 723 K FeO, CuO, Fe²⁺ and Fe³⁺ oxides, MnO and KOH. Mn and K are enriched on the surfaces after calcn. and redn.; the Cu surface content is approx. equal to the bulk concn. The K enrichment is esp. strong and ISS indicates that potassium is mainly confined to the uppermost **layers**. The degree of redn. of Fe is strongly dependent on the amt. of Cu or K. The change in surface compn. during Fischer-Tropsch reaction in the XPS equipment can be correlated to the activity of the **catalysts**. The K contg. **catalysts** deactivate after a short time and are then totally covered by carbon. On all

catalyst surfaces a small amt. of carbonate is formed.

L8 ANSWER 13 OF 18 CAPLUS COPYRIGHT 2000 ACS
 ACCESSION NUMBER: 1985:526250 CAPLUS
 DOCUMENT NUMBER: 103:126250
 TITLE: Design of more selective Fischer-Tropsch
catalysts by using rationalized activity
 patterns
 AUTHOR(S): Snel, R.
 CORPORATE SOURCE: Chem. Eng. Res. Group, Counc. Sci. Ind. Res.,
 Pretoria, 0001, S. Afr.
 SOURCE: Prepr. - Am. Chem. Soc., Div. Pet. Chem. (1985),
 30(4), 723-8
 CODEN: ACPCAT; ISSN: 0569-3799
 DOCUMENT TYPE: Journal
 LANGUAGE: English
 AB An Fe₂O₃C_x (x = 1 in the surface **layer**) **catalyst**
 converted synthesis gas at 2 MPa and 543K to C₂-5 olefins with
 selectivity
 80%; the product contained .apprx.7% CH₄. The C was introduced by
 partial
 degrdn. of Fe citrate complexes.

L8 ANSWER 14 OF 18 CAPLUS COPYRIGHT 2000 ACS
 ACCESSION NUMBER: 1984:141922 CAPLUS
 DOCUMENT NUMBER: 100:141922
 TITLE: First experience and results of the 200-ton/day pilot
 plant Bottrop
 AUTHOR(S): Langhoff, J.; Wolowski, E.; Tamm, H. F.; Escher, G.;
 Hosang, H.; Schmedeshagen, B.
 CORPORATE SOURCE: Ruhrkohle Oel und Gas G.m.b.H., Bottrop, Fed. Rep.
 Ger.
 SOURCE: Proc. - Annu. Int. Conf. Coal Gasif., Liquefaction
 Convers. Electr. (1982), 9th, 396-415
 CODEN: PAIEDI
 DOCUMENT TYPE: Journal
 LANGUAGE: English
 AB The development of and the preliminary operating results from a coal
 liquefaction pilot plant (200 tons/day) developed in Bottrop were
 presented. The conditions of the direct liquefaction process were, e.g.,
 coal feed rate 8.3 tons/h, coal-oil wt. ratio in the slurry 40:60, and
 slurry rate 20.8 tons/h, at 478.degree. and 280 bars. The process
 employs
 an Fe₂O₃ slurry **catalyst** (8 tons/day) and is operating
 successfully. An operational safety precaution involves the protection
 of
 the internal heat-insulating **layer** of the high-pressure
hydrogenation reactor on depressurization.

L8 ANSWER 10 OF 18 CAPLUS COPYRIGHT 2000 ACS
 ACCESSION NUMBER: 1990:539543 CAPLUS
 DOCUMENT NUMBER: 113:139543
 TITLE: Surface structure and catalysis for carbon monoxide
hydrogenation of the supported ruthenium
 species derived from the ruthenium carbonyl

(Ru₃(CO)₁₂) inorganic oxides
 AUTHOR(S): Asakura, Kiyotaka; Iwasawa, Yasuhiro
 CORPORATE SOURCE: Fac. Sci., Univ. Tokyo, Tokyo, 113, Japan
 SOURCE: J. Chem. Soc., Faraday Trans. (1990), 86(14), 2657-62
 CODEN: JCFTEV
 DOCUMENT TYPE: Journal
 LANGUAGE: English

AB Various kinds of supported Ru clusters were prep'd. by using the surface reaction of Ru₃(CO)₁₂ with inorg. oxides such as V₂O₅, SiO₂, TiO₂, Al₂O₃, K-doped Al₂O₃, and MgO followed by H₂ redn. at 723 K. Their structures were det'd. by means of EXAFS. Ru₃(CO)₁₂ supported on V₂O₅ was converted to 3-at.-**layer** Ru metal particles, whereas one-at.-**layer** Ru clusters were produced on SiO₂ (n = 12) and TiO₂ (n = 6). The clusters [Ru(nOZ)x] (Z = Al or Mg) with Ru-O (surface) bonds were formed on Al₂O₃ (n = 6), K-doped Al₂O₃ (n = 6), and MgO (n = 3). The difference of the Ru structures on inorg. oxides may be related to the different acidity and/or basicity of the metal oxides. The catalytic properties of these different Ru structures were exam'd. in CO **hydrogenation**. CH₄ was predominantly formed on Ru₁₂ on SiO₂. The 6-Ru atom clusters

with the Ru-Ru distances of 0.262-0.265 nm showed the highest selectivity for the formation of C₂-C₄ hydrocarbons. The metallic Ru₆ clusters on TiO₂ had a higher activity than the [Ru₆(OAl)x] clusters bonded to the surface through O atoms. The smallest surface-bound clusters on MgO produced mainly CH₄ and CO₂. These results demonstrate that CO **hydrogenation** is a structure-sensitive reaction, depending on the size and oxidn. states of the Ru clusters.

L8 ANSWER 8 OF 18 CAPLUS COPYRIGHT 2000 ACS
 ACCESSION NUMBER: 1992:197524 CAPLUS
 DOCUMENT NUMBER: 116:197524
 TITLE: **Hydrogenation** of residual oils
 INVENTOR(S): Oishi, Yasuyuki; Sakai, Masato; Kubota, Yasuhiro;
 Shimizu, Kazuo; Yamashita, Chuichi; Inoue, Akira
 PATENT ASSIGNEE(S): Nippon Petrochemicals Co., Ltd., Japan; Zaidan Hojin
 Sekiyu Sangyo Kasseika Center
 SOURCE: Jpn. Kokai Tokkyo Koho, 7 pp.
 CODEN: JKXXAF
 DOCUMENT TYPE: Patent
 LANGUAGE: Japanese
 FAMILY ACC. NUM. COUNT: 1
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 03292394	A2	19911224	JP 1990-93919	19900411
JP 2986838	B2	19991206		

AB The residual oils are hydrogenated at H pressure .gtoreq.100 kg/cm², LHSV 0.1-1.0, and temp. .gtoreq.300.degree. in a reactor consisting of 1st **layer** filled with Al₂O₃-supported **catalysts** contg. 1.0-7.0% active metal oxides of Ni, Co, Mo, V, and/or W and having total surface area measured by N adsorption method (A) .gtoreq.150 m²/g, av. pore diam. (D) .gtoreq.100 .ANG., total pore vol. (V) .gtoreq.0.6 mL/g, and vol. ratio (R) of pore with av. pore diam. 120-200 .ANG. in total pore

A vol. .gtoreq.75%, and 2nd **layer** filled with Al₂O₃-supported **catalysts** contg. 8.0-15.0% active metal oxides of Ni, Co, Mo, V, and/or W and 0.5-10.0% P compd. oxides and/or B compd. oxides and having .gtoreq.150 m²/g, D .gtoreq.100 .ANG., V .gtoreq.0.5 mL/g, and R of pore with av. pore diam. 100-200 .ANG. in total pore vol. .gtoreq.75%. The process is suitable for removing S, N, Ni, V, etc., from the residual oils.